WAR BREAD

Alonzo
E.
Taylor

Library
Brigham Young University

Call No. 641
T21
copy 2

Acc. No. 22421

WAR BREAD

THE MACMILLAN COMPANY
NEW YORK · BOSTON · CHICAGO · DALLAS
ATLANTA · SAN FRANCISCO

MACMILLAN & CO., LIMITED
LONDON · BOMBAY · CALCUTTA
MELBOURNE

THE MACMILLAN CO. OF CANADA, LTD.
TORONTO

WAR BREAD

BY

ALONZO ENGLEBERT TAYLOR

Professor of Physiological Chemistry, University of Pa. Member of the United States Food Administration and of the War Trade Board, Washington

New York

THE MACMILLAN COMPANY

1918

All rights reserved

COPYRIGHT, 1918
BY THE MACMILLAN COMPANY

Set up and electrotyped. Published, May, 1918

DEDICATED TO

HERBERT CLARK HOOVER

IN THE HOPE THAT IT MAY AID HIS
FELLOW CITIZENS TO
SUPPORT HIM

TABLE OF CONTENTS

	PAGE
Our Duty	7
What the Allies Need	16
What We Possess	28
Why We Are Limited in Wheat	40
Food Value of the Different Grains	50
Ways of Stretching Wheat	62
Waste in Wheat	93

WAR BREAD

OUR DUTY

IT is my purpose to present briefly and in untechnical language a statement of the wheat problem that is now confronting the people of the United States. I have used the title War Bread because with us every problem in cereals ultimately ends in the question of bread. The bread-grains are wheat and rye. If we are *short* of bread-grains, we must modify our bread. If we are *very short* of bread-grains, we must substitute other cereals for bread. Every bread-eating people clings to bread as long as possible, an expression of psychology rather than

of physiology. The war problem of bread is also entangled in factors of industry and trade that demand and deserve careful consideration.

War bread did not come to our Allies as one of their earliest burdens in the war. It comes to us with the first of our war obligations. The proper definition of our relations to our Allies states that we will share with them every responsibility, over-load, sacrifice, saving and loss, in order that with them we may justly share in the cultural, geographical, and governmental freedom that success of the allied armies will bring. Prior to our entrance into the war, the allied peoples had suffered losses in resources and in men of which our people have no conception. No matter what sacrifices and losses the future may bring, it is not possible that our total relinquishments at the end of the war, in

proportion to our resources and population, can equal those of the allied peoples. When a few brave Americans are killed in a trench sortie in France this tragedy is announced in headlines in our daily papers. In the papers of the Allies are published once a month statements of monthly casualties that run into tens of thousands. This comparison illustrates our respective losses in the war to date. It is from every point of view the imperative duty, and ought to be esteemed the privilege, of the American people to assume our full share of the war burden.

Our Government, our military and naval forces and our industries are effectively active in participation in the war, but our people have only commenced individual participation in war work of serious import. The first real war work devolving upon the Amer-

ican people as a whole lies in the adaptation of our mode of living to meet the food situation of the allied peoples. Regarding ourselves as united with our Allies in every point of effort, sacrifice, saving and loss, our total foodstuffs ought to be at the least equally divided. We must regard the stretch of water between the United Kingdom and France as a fiction, the range of mountains between Italy and France as non-existent, and the expanse of ocean between North America and Europe as but an incident in transportation. We must regard all of our foodstuffs as pooled. The very least that ought to be done is to assure to each man, woman and child in the United Kingdom, France and Italy the per capita portion that would accrue to each of the 235,000,000 individuals comprised in our combined populations if all the foodstuffs of the United

Kingdom, France, Italy, Canada and the United States were pooled and divided pro rata. Any lack would then be quantitative, a division to each person share and share. But more than this, in consideration of the fact that the Allies are carrying burdens so much larger than ours, particularly burdens applied to the household, if there be ever a choice presented or enforced by circumstances between them and us, we ought to choose the harder part. If there be alternative between greater or lesser labour in the preparation of food, greater or lesser convenience in household management, higher or lower satisfaction in the diet, richer or poorer maintenance of the normal ration in quality or articles, we should make it our privilege to assume the worst part and to bestow upon them the best part.

This resolves itself into different duties with the two sexes. Applied to men, it is the duty of men in America to accept without complaint such alterations in our diet as will enable the men of the United Kingdom, France and Italy to have a diet as nearly as possible adapted to their needs, tastes and customs. Applied to women, it is the duty of women in America to assume additional burdens in the household in the preparation of food and to accept changes in the accustomed diet, in order that the women of the United Kingdom, France and Italy, may have their burdens of household management reduced to the lowest possible level. American men must visualize what the men of the Allies have been through and what they are enduring now. With this must be contrasted what we have been through and what we are enduring now. The

women of America must visualize what the women of the Allies have been through and what they are enduring now, and compare this with what our women have been through and are enduring now. From these comparisons, the duties of the men and women of America will become glorified into privilege.

It is the purpose of the following pages to make clear just what must be accomplished in order that we may give to every member of the allied peoples his full share in our pooled foodstuffs, at the lowest comparable cost and with the least labour. It is not to be inferred that the food problem concerns bread alone. We must consume less of sugar, meats and fats than has been our custom, in order to supply the allied peoples with amounts that shall enable them to raise their reduced rations to a plane less below

their normal. The bread problem is however the most pressing.

Difficulties in transportation will make it impossible for the Allies to secure during the coming months the normal quantities of food. There is no prospect of a reduction of American foodstuffs. Our efforts must be to hold the quantity of the foodstuffs of the Allies to the highest point permitted by transportation facilities, and to make their diet in the qualitative sense as close to the normal as possible. In order to do this, we do not need to reduce our diet in quantity, but it is imperative that it be modified, and these modifications apply to cereals more than to any other articles in our diet. We need not fear that our diet, as a people, is endangered; our fixed habits alone are endangered. Only one fourth of the human diet is con-

cerned with indispensables, three fourths are substitutables, our food problem is concerned with the latter alone. Applied to particular comestibles rather than to physiological constituents, the diet is a mixture of essentials and nonessentials; of the former there are few, of the latter many. To continue this year the diet of custom amounts to adopting a pro-German diet.

WHAT THE ALLIES NEED

THE season of 1917 brought poor crops to the allied nations in Europe. The yield in wheat, rye, barley, corn and rice for human consumption in the United Kingdom, France and Italy reached a total of only 10,600,000 tons. This is less than half of the normal cereal consumption of these peoples. The crop failure was due to unfavourable weather, lack of labour, scarcity of fertilizer and depletion of work animals. When one considers that in France agriculture was carried on almost entirely by women, reduction in yield was not to be wondered at, even under favourable climatic conditions.

The people of the United Kingdom

consume cereals to the extent of about one-third of their diet; the people of Italy to the extent of over 40 per cent.; bread constitutes over half of the subsistence of the people of France. Crop failure endangered the most essential article of the diet. In order to secure the cereals required to maintain their subsistence, our Allies needed to import from the United States, Argentine and India an amount of cereal equal to the home-grown grains. The amounts of wheat and rye desired from North America, where grain was first available, was about 7,000,000 tons, leaving 2,000,000 million to come from the Argentine and 2,000,000 to come from India. To haul wheat from India to Italy is an economic run, but to haul wheat from the Plate to Europe is a waste of tonnage compared with the haul from the United States.

In order to appreciate the position of the Allies, one must consider not only the quantity of cereals but also the methods of consumption. The inhabitants of the United Kingdom, France and Italy are essentially bread eating peoples. There is a small consumption of oatmeal and rice in the United Kingdom. Italy consumes considerable rice, which is there a staple dish. The people of Italy also consume a million and a half tons of corn per annum in the state of polenta. In addition to the use of bread, wheat flour is used widely in Italy in the preparation of pastes. In France the cereals largely consumed are wheat and rye, and these almost exclusively in bread. Viewing the Allies as a whole, we may say that it was their normal practice to consume 90 per cent. of their cereals in wheat.

Practically speaking all bread con-

sumed in the allied countries is baked in shops, home baking being almost unknown. Since forty per cent. of the food of the Allies is bread and this bread is baked in shops, it follows that only sixty per cent. of their food is prepared by the housekeepers. Since the women of the Allies are already overworked to a serious degree, it is of particular importance that this 40 per cent. of ready-to-serve food should not be reduced, since this would result in additional household labour being imposed upon them.

It is not possible to make bread on a commercial scale with less than 70 per cent. of wheat and rye flour. These are the grains that contain gluten, which when mixed into dough and raised under the action of yeast yields a bread that can be transported, keeps well and meets all of the desiderata of a staple cereal food. It is, there-

fore, important that we should supply the Allies with wheat and rye, (to which may be added barley), to the extent of 75 per cent. of their total cereal needs, if they are to maintain their normal habits of bread consumption. They can use 25 per cent. of rice, oats or corn to make mixed bread with 75 per cent. of flour prepared from wheat, rye and barley in the proportions available to them. If, however, the amount of rice, corn or oats rises above 30 per cent., commercial baking of bread ceases to be possible, and these people will have to have breadless meals, and for these meals cereals in other states than bread must be served. Our allies accept corn gladly for use in mixed-flour bread. That we have sent them relatively little this winter was due to the high water content of the corn of last year's crop and to the disorganization of

railway transportation during the winter months. Corn cannot be sent over during the spring months on account of liability to germination.

There is no mystical property in wheat or bread. The use of cereals in the form of bread is merely a matter of convenience, but this becomes of vital importance in the stress under which the women of the Allies are at present labouring. It ought, therefore, to be the purpose of our people to yield to the Allies such amounts of wheat and rye as, added to their own, will enable them to have three-fourths of their total cereals in the state of bread-grains, in order that their cereal consumption may occur, as in their normal lives, largely in the form of bread. If this is not done, then we compel them to serve boiled rice or hominy, oatmeal porridge, corn meal mush or corn pone instead of bread.

Apart from the use of polenta and risotto in Italy and the use of oatmeal and rice in England, these people do not understand the routine use of these cereals. They would have to devote additional labour to their preparation. If the 2,000 homes in a French village purchase their bread from one baker, this means that half of their food will be prepared by a few men in a single well-equipped bakery, with very little outlay of fuel. But if, instead of issuing the total cereal in the state of bread, only two-thirds is so issued, the result will be that in each of the 2,000 homes the cereal portion for one meal in the day will have to consist of cooked rice, oatmeal, corn mush or corn bread. This will require at least half an hour of the time of the over-worked woman. It will require fuel,—with coal at $110.00 a ton. It will impose upon the mem-

bers of these suffering families the use of foods to which they are unaccustomed. We know that to use these cereals acceptably requires sugar, milk, butter or fruits, in excess of the amounts needed when bread is consumed. We have milk, sugar, butter and fruits in abundance. With the sugar rations of the Allies, the use of sugar with a breakfast cereal is out of the question. Their dairy stock is seriously depleted; the ration of butter is very low; they lack fruits. They would have to use the cereals plain, which we know by experience, would not be palatable.

The use of rice, corn and oatmeal would be just as healthful for the Allies as the use of bread composed of three-fourths bread-grains. It is not a question of healthfulness. It is a question of work, habit and palatability.

From every point of view, it ought to be regarded as reasonable and natural that Americans should wish to maintain the normal cereal intake of the Allies in the form of bread. The bread with 25 per cent. of corn or oats will not be a natural bread, but it will be a bread of good, nourishing qualities, if not of normal taste. It will enable them to maintain their cereal intakes in the normal proportions of their diets, without forcing upon them any additional labour in the preparation of their food. The bake-shops of these countries have learned to make mixed breads. The traveller from America, recalling the splendid bread of France, will scarcely recognize French bread in the present product. But it is *bread;* it can be bought in convenient amounts, represents the normal proportion in the diet, and as such is gratefully accepted,

since the people of France have ceased to be hypercritical of their bread. The bread is not merely a mixed bread; it is a bread of much higher extraction. Wheat is now milled to 85 per cent. in France, and this flour forms the basis for the mixed-flour bread. Under these circumstances, commercial bakers have not found it possible to make bread of the texture for which French bread was noted. The bread is frequently soggy, it is apt to be heavy, and it is unquestionably less digestible than the normal French bread. It is not a normal bread in taste, due to the presence of other cereals; but it is, as stated, *bread*, and as such fills the extremely important rôle of bread in the diet.

The same argument holds for the peoples of the United Kingdom and Italy, almost to the same extent as for France. They are not as dependent

upon bread as are the French, but as pastes can only be made from wheat flour the argument applies fully to Italy. In England, while the amount of bread is not as large, nevertheless, the dependency of the labouring classes upon bread has always been pronounced. We can eat breakfast cereals two meals in the day if necessary, the Allies need bread three meals each day.

The bread ration has been recently reduced in all of the allied countries. Up to December, they had attempted to maintain the bread ration in normal quantity. Scarcity of tonnage, due to the ravages of the submarine, have finally made it necessary to reduce the bread ration. This has been done in all of the three countries. The present bread ration in France provides daily of mixed-flour bread the following amounts to the designated classes:

Children less than 3 years old. 3.5 oz.
Children from 3 to 13 years.. 7.0 oz.
Hard workers 13 to 60.....14.0 oz.
All others from 13 to 60.....10.5 oz.
Over 60 years of age..... 7.0 oz.

This represents a material reduction in the total bread intake of the Allies. The reduction may prove to be as large as 25 per cent. Even with the great scarcity of tonnage, it is imperative to transport to the Allies the amounts of wheat necessary to prepare bread in the amounts required according to reduction in the ration. Whosoever wishes to aid the Germans this summer will eat bread three times a day; whosoever wishes to aid the Allies will give them bread three times a day.

WHAT WE POSSESS

OUR situation after the needs of the allied nations for wheat during this year have been satisfied is easily presented in rounded statistical form. Subtracting from the wheat crop, 650,000,000 bushels, the seed requirements and the amounts that have been exported and are committed for export to the Allies, leaves for consumption in the United States about 400,000,000 bushels, as against a normal of 500,000,000. Our population is 105,000,000 and we have also commitments for flour to Cuba, Panama, Mexico and Central America for the support of essential war industries that bring it up to at least 108,000,000. This corresponds to less than four bushels of wheat per capita per year.

22421

Extracted according to our present milling practice, this corresponds to about 162 pounds of flour for the year, or 13.5 pounds per month, per person.

The voluntary conservation measures of the United States Food Administration, introduced in the fall of 1917, if realized, would enable us to fulfill our obligations to our Allies and carry our wheat consumption through the year, at the rate of not over a half pound of flour per day. The full hopes of the Food Administration as to the total results of voluntary conservation have not been realized. There is evidence that while perhaps 30 per cent. of our population have conserved wheat, increased consumption has occurred with the remainder, partly as an expression of increased need due to heavier work, since wheat flour was almost the

cheapest food; and partly as the result of increased wage, which in any people and under all circumstances, leads for a time to increased food consumption. It is not possible in a definite manner to determine what the consumption has been to date and what is left for the balance of the year until the new crop comes in. In an approximate manner, however, this can be stated, and it must be stated in such a way as to present a safe estimate from the standpoint of conservation.

We will accept as the figure for the normal consumption of flour 216 pounds per capita per year, 18 lbs. per month. I assume that during the first half of the crop year, consumption has occurred at this rate, corresponding to 108 pounds. Available to each person throughout the year were 162 pounds. Subtracting 108 from 162 pounds leaves 54 pounds,

which represents approximately the amount of flour available for each person in the United States until the new flour enters the market. This corresponds to nine pounds per month, or one-half of the normal consumption. The rye flour is nearly exhausted. There is a certain production of barley flour, but for practical purposes we must accept it as correct to say that nine pounds of wheat flour per month represents during the present summer the maximum amount of flour available to each person in the United States. It may be less.

Our normal total cereal consumption was somewhere in the neighbourhood of 22 pounds per month, of which approximately eighteen pounds was in the form of wheat flour, leaving only four pounds as representing the consumption of non-wheat cereals. In the south, large numbers of people

consume less than ten pounds of wheat flour per month with twelve pounds of corn. We have many people in the north who consume practically no other cereal than wheat flour. Now, to achieve the task set before us, that is to stretch the consumption of wheat flour so that it will last until the new crop, each person must limit his consumption to at least nine pounds per month, and if the total cereal intake is to be maintained at twenty-two pounds, this means the consumption of non-wheat cereals must rise to thirteen pounds.

Now in order to attain a certain saving, it is for reasons of trade and industry, as well as for reasons of psychology, demonstrated by human experience that one must aim at a higher retrenchment than for the minimal figure set for accomplishment. For the poorer classes in our cities reduction

in flour consumption is difficult. The present program of the Food Administration runs to the effect that there shall be two wheatless days per week and one wheatless meal each day. In other words, of the twenty-one meals, eleven are to be wheatless and ten are to contain wheat. A certain amount of flour must be used in the kitchen in the preparation of sauces and gravies. The standard bread is a preparation of seventy-five parts of wheat flour and twenty-five parts of admixing cereals.

For some time the Food Administration has had in operation a fifty-fifty rule, that one could purchase wheat flour only by purchasing an equal weight of other cereal, indicating the wish of the authorities that we should consume non-wheat cereals in amounts equal to wheat flour. To play safe, we should do more than this. A safe rule for the average family

would be to limit the *wheat flour* consumed in all forms to *six pounds per person per month.*

The physical article *bread* has a psychological value in the diet. To the people of means, bread eating is largely a habit, as is well illustrated in the munching of bread in public eating places while waiting for the food that has been ordered to be served. But with the working classes bread has a value that can be compared to the arch of the keystone, and it cannot safely be reduced below a certain amount. This bread may be mixed-flour bread, whole-wheat bread or white bread; but it must be bread and it cannot be replaced by cooked cereals. The figure for the amount of bread to be regarded as indispensable depends upon custom, viewpoint and financial means. Leaving aside the first two as outside the

domain of quantitative evaluation, the relation of the purchasing power of a class to its bread needs may be expressed in the statement that the more limited the means the more important the bread and the larger the amount demanded. Bread and potato are all that Germany can give to her working classes in anything like normal amounts; and therefore the public reacts to any change in the bread ration with almost explosive violence. We have more meat, fats, sugar and vegetables for our working classes than have Great Britain, France and Italy. Therefore, bread is more important to our Allies than it is to us. To our classes of means, including the so-called middle class, bread is largely a dispensable article of diet; to our working classes, bread is indispensable. We are short of wheat. Therefore, our working classes and those

of low means should have more than their numerical share, the sedentary classes less. This is all the more true since wheat flour is one of the cheapest foods on the market, and it is therefore at this time the duty of people of means to forego wheat. Biscuit makers who for years have turned out little else than wheat crackers, are now producing excellent crackers of other cereals.

Now, if our consumption of non-wheat cereals represents an average of four pounds per month per person and this is now to be raised to at least thirteen pounds per month per person, we must give a figure for the increased amounts of barley, rice, corn and oats that must be consumed in order to maintain the total cereal intake. The previous consumption was 420,000,000 pounds per month. This must rise to 1,365,000,000 pounds per

month. We have available for consumption in the shape of domestic rice 85,000,000 pounds per month. Oatmeal and rolled oats are produced in our mills at the rate of about 135,000,000 pounds per mounth. Corn meal was produced at the rate of 600,000,000 pounds per month, though this represents a normal inefficiency and not the potential output at all. The total of these is, therefore, 820,000,000 pounds per month as against the need of 1,365,000,000, leaving a deficit of 545,000,000 pounds of supplementary cereals per month. The amounts of barley, buckwheat, rye and other cereals remaining could not furnish over 200,000,000 pounds per month. To cover the deficit we must either import rice, produce more oatmeal and rolled oats, turn out more corn meal and hominy, or import wheat from Argentine or Australia.

If we have effected material conservation in wheat, this will find expression in a diminished demand for supplementary cereals in certain sections of the country, and have the effect of lowering the figure for the amount of supplementary cereals required.

The crux of the situation does not lie in the supply of corn and oats, but in milling facilities and transportation. The milling of corn in this country is inefficiently done from the quantitative point of view, and is capable of large and immediate expansion. Mills not primarily built for the milling of corn can also be adapted to this end. With the amount of wheat at our disposal, our milling facilities are only partially employed, and although considerable reconstruction and adaptation may be necessary, these are being accomplished and the substitutes are flowing freely to mar-

ket. Corn more than once saved the early settlers of New England from starvation, and was during the civil war the chief support of the southern people.

In practical terms, therefore, our situation, when the needs of the Allies have been filled, may be stated to the effect that one-third of our cereals is in the state of wheat flour and two-thirds in the state of products of rice, oats, corn and the other cereals; and since these substitution cereals cannot be combined in the form of bread, as the term is usually understood, our people will have bread for one-third of their meals and supplementary cereals, cooked or baked in one state or another, for two-thirds of the meals. This state of affairs must certainly endure until September; whether it will be necessary later, depends upon the crop of 1918 here and abroad.

WHY WE ARE LIMITED IN WHEAT

THE scarcity of wheat is directly the result of crop failure, since the crop of 1917 was low. The crop of 1916 was also low, but this was compensated for by the bumper crop of 1915. It is unusual for crop failure to occur in three successive years, except as the expression of human factors. Nevertheless, the past three years have each given a subnormal crop of cotton, and we must realize that the year of 1918 may bring the third successive low yield of wheat.

Viewed broadly, our low production of bread-grains is the expression of our type of agriculture. It represents our definition of yield in terms of

men rather than in terms of acreage; and also the tendency of our agricultural processes to revolve about animal husbandry. On superficial contemplation, it seems strange that we should have approached the limit in our per capita production of bread-grains. As a matter of fact, the United States had ceased to be an exporter of bread-grains; we had been scarcely more than self-supporting; we were inevitably becoming an importer, relying upon Canada for a portion of our supplies. Of our total land surface of over 1,903,000,000 acres, about 900,000,000 are at present defined as farm area, of which about 500,000,000 are improved, that is, under cultivation in the broad sense of the term. The largest acreage ever planted to bread-grains was in 1915, nearly 70,000,000 acres, less than one-seventh of the improved land.

The prospective acreage in wheat, barley and rye for the year 1918 may be estimated to be in the neighbourhood of 75,000,000 acres, and represents, apparently, the maximum that can be obtained under present conditions of cultivation of the soil. This limitation is an expression partly of the operation of the law of diminishing returns as applied to the raising of the cereals themselves, partly the expression of competition with other crops and with animal husbandry. There is a great deal of discussion of the planting of the marginal area, whether this be applied to acres in individual farms or to areas in the different zones. Of course, this could be accomplished if the yield per acre could be maintained to the average. But this could be expected only if we possessed abundant farm labour, adequate supplies of fertilizer and un-

limited implements. These we have not, and if we did possess them, we would not cultivate the marginal area. We would practise instead intensive cultivation, and upon a smaller acreage devoted to bread-grains, raise double the yield per acre that is attained with the present practices.

There are four main areas devoted to the raising of bread-grains. The first is east of the Mississippi, running across the central section, as far north as southern Michigan and New York. This area produces winter wheat largely, is reliable in yield, and from the purely rotation point of view, capable of considerable expansion in acreage. The second area is the southwestern belt, including Missouri, southern Nebraska, Kansas, Oklahoma and the contiguous areas of Texas and Colorado. This is also a winter wheat belt, but exposed to

unfavourable climatic conditions, winter killing and drouth being frequent. The third area is the northwestern spring wheat belt, including the country from the Mississippi to the Rocky Mountains, a direct continuation of the Canadian spring wheat belt. This is also a section of unfortunate climatic conditions; the seeding is often so greatly delayed by late spring that the farmer has difficulties in preparing his soil and the crop barely time to mature before frost, and the area is also liable to excess or deficiency in rainfall. The last area is the Pacific belt, including in this all the states west of the Rocky Mountain Divide. California was once a prolific producer of wheat, but exhausted her soil, through repeated cultivation without rotation. The northern Pacific states yield richly in the bread-grains, and are relatively

free of untoward climatic influences. It is an unfortunate fact that those areas that have statistically the best climatic influences have the least possibility of expansion. One must not make an estimate of acreage without at the same time having before one the figures of planting and of harvesting, with the records of abandonment.

Following upon a governmental survey, the acreage of winter wheat recommended in the fall year of 1917 was over 47,000,000 acres. Owing to drouth in the southwest, the seeding according to this recommendation was not fully accomplished, but over 42,000,000 were secured. The condition of the wheat on the first of December was below eighty per cent., the lowest in years. During the winter the condition has been considerably improved, owing to protection by an abundance of snow. What the future

holds in rainfall, drouth, frost or parasitic diseases cannot be foreseen. The acreage of spring wheat that will probably be attained may be estimated conservatively at 20,000,000. If from this combined acreage, plus rye and barley, we secure a yield that is large as an expression of favourable climatic conditions, with a low ratio for abandonment and a high figure for yield per acre, the bread-grain crop of 1916 may represent 1,100,000,000 bushels. On the other hand, with unfavourable conditions in temperature, rainfall or parasitic diseases, the yield may fall as low as 700,000,000 bushels, without exceeding the common measure of unfavourable results in the past. If we should secure a billion bushels, this would probably mean a large crop of spring wheat for Canada, where it is hoped

15,000,000 acres will be planted, and under these circumstances we and our Allies would have little concern over bread-grains after the first of September. If, however, we secure a yield as low as 700,000,000 bushels, this would probably mean also a low spring wheat yield in Canada, and we and our Allies would face after the first of September a continuation of the same situation of scarcity and stringency that now confronts us. It is imperative that we place in operation measures of conservation that will continue over into the coming year and they must be designed to that end, since that is the only procedure of safety. With the continuation of the war into another year, that is, with the necessity of planting a war crop for the year 1919, we would face the same situation as this year, except that

labour would be still scarcer, machinery more depleted and fertilizer still less available.

The only possible deviation from the program as set forth would be a violent dislocation of agriculture, with heavy reduction in the planting of all feed crops, especially corn and oats, attended by consequent reduction in the number of domesticated animals. This, which has already been made necessary in every European country at war, has not yet become necessary here. If the price of wheat were to be fixed very high, say at four dollars per bushel, wheat would be planted to the disastrous neglect of other crops and of domesticated animals. Wheat would be secured, but the state would have to pay for bread for a large section of the people. If we have wheat failure in 1918, the sole escape from violent dislocation of agricultural

practices in 1919 would lie in the importation of bread-grains from India, Argentine and Australia, made possible by the conquest of ship-building and depth-bombing over the operations of the submarine. Our agriculture, like our diet, operates with or against the submarine.

FOOD VALUE OF THE DIFFERENT GRAINS

THE substitution of oats, corn, rice and other cereals for bread-grains rests upon sound physiological consideration. Under bread-grains, we include in the order of their importance from the standpoint of bread-making, wheat and rye. Barley, corn, oats, and rice are not technically regarded as bread-grains at all, because yeast-leavened bread cannot be prepared from them. On analysis, these grains are found to be similar in composition, whether analysed whole or after being processed into flour. With different varieties and in different seasons, they contain in different countries from eight to twelve per cent. of

protein, with the exception of rice that may be as low as six per cent., and oats that may run over fifteen. With comparable water content, the carbohydrate varies from sixty-five to seventy per cent., the fat from one to two per cent., with the exception of oats which may be as high as six per cent.

The flour of any one is worth in the neighbourhood of 1600 calories per pound, oatmeal being the highest. In a mixed diet where the cereals represent about one-third of the foodstuffs, the variations are entirely negligible, barley being the lowest and oat-meal the highest in food value. When fed in a mixed diet to animals, these grains are of equal value. When animals are fed upon one grain alone, including leaves and stalks, wheat is, apparently, the poorest of the grains. In mineral content, they are of approx-

imately equal value. The proteins of all these grains are to be regarded as unbalanced and in equal measure, though this again is a question of no importance in a mixed diet.

These grains are all equally digestible, for practical purposes. Rice is perhaps rather more digestible than corn and oats, possibly on account of the lower fat content; but the degree of absorption of protein, fat and carbohydate is practically identical in all. The digestibility of the different grains apparently holds for all ages, being largely an expression of proper cooking. Corn in occasional individuals gives rise to mild attacks of hives. The common opinion that corn and oats are heating is a vulgar error.

Certain individuals would seem to be concerned over the propriety of reduction of wheat flour in the ration of children and invalids, for whom

toasted wheat bread has long been regarded as a most appropriate cereal.

As a matter of fact, in the dietary of the sick, rice and barley have long enjoyed a particularly high reputation. In the compounded infant foods, barley is the flour commonly employed and not wheat; and pearl barley is indeed put to scarcely any other use than for the sick. In truth, the method of preparation and the thoroughness of the cooking are the essential points and not the kind of cereal. In the dieting of delicate children and invalids, variety is almost as important as digestibility, and the wheat conservation program of the United States Food Administration places no limitation upon the use of wheat flour in this way.

On the other hand, it must be clearly realized that most of the preference

for wheat flour is notional and not digestive. Certainly with adults who are leading their usual lives, it will be very rarely found that toleration for wheat bread co-exists with inability to digest the other cereals. We may accept it as a rule that the man or woman who wishes now to insist on the customary use of wheat flour is either a crank or a slacker.

The reputation enjoyed in the Caucasian world by wheat pre-eminently, and to a lesser extent by rye, rests upon the physical properties of the protein. Wheat contains a substance called gluten. Rye contains a similar substance to a lesser extent. We will regard them for the purpose of discussion as identical. Gluten is a tough, elastic, tenacious substance, which dilates with air spaces when bread is raised with yeast, precisely as soap bubbles are formed when air is blown

into soap suds. When yeast acts in a dough of corn, rice or oats there is no cohesion in the mass, there will be little increase in volume, and when it is baked the product is of granular texture. When yeast acts in wheat-flour dough the mass rises, the gluten stretches and the entire loaf dilates. When the bread is baked the gluten is coagulated, and in this condition holds up the porous, airy structure of the bread, precisely as the white-of-egg holds up the structure of sponge cake. When surrounded by a proper crust so that the moisture is retained, the bread keeps for days its attractive qualities. It is easy to transport, not prone to decomposition, and is in every way a durable and, therefore, an attractive article of food. Rice, oats and corn cannot be used to prepare bread of this type. They form cakes, biscuits, wafers or pones, like

corn bread, which is not bread at all, breaks easily, dries out, cannot be transported, and must be consumed within a few hours after being prepared. Baked with fats and sugar, rice, corn meal, and oatmeal can be used to form cakes of various kinds that are durable, but these are not bread.

Bread is the only cereal food product that can be prepared on a large scale by commercial bakers and distributed without containers. The gluten of wheat stands alone in its qualities in this respect. It is possible to bake a straight rye bread, although it will be soggy rather than light and this is rarely done, even in rye-eating countries. It is not possible to bake a straight barley bread, but it is possible to combine it with equal parts of rye or wheat. On the Continent the customary rye breads usually contain

thirty parts of wheat, while the bread of the better classes contains seventy parts of wheat and thirty parts of rye. Rarely do rye breads in the United States contain over thirty parts of rye.

The value of the bread-grains lies, therefore, in the efficiency of preparation, in the transportability of the product and in the keeping qualities. Since bread can be cut into slices it lends itself to convenience in household service.

We rarely eat bread without butter or fruit, yet we do not realize how the consumption of breads depends upon the materials spread upon it. The German people realized this dependence, on a nation-wide scale, during the past two years. With a very low fat ration and fruit and sugar scarce, the need of some spreading material was so keenly felt by the masses that

the government devised and fabricated a jam composed largely of turnips, merely to supply something that could be spread upon the bread.

Races other than Caucausian have usually centred their nutrition around other cereals than wheat, notably around rice. The nutrition of Japan centres around the soya bean and rice; that of the Chinese around rice, while corn has gradually forged forward in areas where it is particularly adapted to cultivation.

Barley was once widely used on the European Continent. It was replaced by rye, that has gradually given way to wheat, though rye is still the staple bread of Russia, Austria, Germany and the Scandinavian countries. Oatmeal in Scotland has yielded to wheat within the last century. In this country, despite the fact that our crops of corn and oats are more readily main-

tained, the diet in North America has centred around wheat, though in the south wheat shares honours with rice and maize. Many elements enter into the choice: price, household convenience, taste, appearance, labour, fuel, etc.

Bread, whether of wheat or rye, can be baked in public establishments and delivered to the house, while corn, oatmeal and rice must be prepared in the home, usually for a single meal, bread being consumed by preference upon the second or third day. Another use of wheat is in the form of quick-rising biscuit, prepared with baking powder, which gives a hot table bread in short time and with little labour; though perhaps from the standpoint of health, the practice is not to be recommended, it has been widely adopted on account of ease and convenience. Wheat lends itself better than any other

cereal to the preparation of cakes, pastries and desserts, and is thus the flour of luxury even in those countries where rye is the bread of necessity.

Our predilection for wheat is an expression of our prosperity, of our desire to consume those foods that possess the greatest attraction from the standpoint of appearance and taste. It has no physiological basis and must be judged in war-time for exactly what it is;—an expression of taste and convenience rather than an expression of utility.

Many Americans, on realization of the situation, have felt it to be their part to eschew the use of wheat until the new harvest. The large hotels of the country have taken the pledge to serve no wheat from the 1917 crop. To live for three months without wheat is not a difficult thing to do. Certainly not in the summer months, with

our profusion of vegetables and fruits. If one fourth of our people would do this, the saving in wheat would provide a priceless insurance fund for the United States Food Administration.

WAYS OF STRETCHING WHEAT

WHEN the wheat flour of a nation runs short there are three ways in which adaptation may be accomplished:—direct substitution, the use of mixed flours, and higher extraction of the wheat in milling. The method any particular people will adopt will be determined in part upon their previous customs. Factors of trade and transportation also exert an influence, as well as the state of supplies in other foodstuffs. In the nations at war all three methods have been employed.

Direct substitution offers the most obvious way of saving wheat. The average consumption of wheat flour in this country is 18 lbs. per person per

month. The housewife arbitrarily reduces her purchase of flour to 6 lbs. per month for each member of the family and limits the bread, cakes, and desserts she prepares, and the use of flour in sauces and gravies, to the fixed amount. At the same time she increases her purchases of rice, barley, cornmeal, hominy, oatmeal and other cereals to fourteen pounds per month, and serves them instead. This is the most direct method of saving wheat; it is from many points of view the most satisfactory, and leads directly to the specified saving. Where the household purchases bread the housewife knows that four pounds of bread represents three pounds of flour. All purchases of wheaten crackers, pies, pastries, cakes and like articles must, of course, also be counted in. From the standpoint of many families, it will represent the most satisfactory solu-

tion of the problem to use bread made of standard wheat flour limited to the specified amount, and serve the substitution cereals as separate dishes.

In the present state of the wheat stocks in this country, it would probably meet the conservation program of the Food Administration to have the purchase of flour per month limited to eight pounds per person; six pounds would be safer. To maintain the usual cereal intake, some fourteen pounds of substitution cereals would be required per month per person. There is a great deal to be said in favour of having normal bread, even though we have much less of it. How the housewife serves the bread and substitution cereals would depend upon the tastes of the family and the condition of her larder. She might elect to serve bread only at one meal of the day, the heavy meal, serving

substitute cereals upon the other two meals. She might elect to dole out a twenty-first part of the bread ration for the week with each one of the meals, and serve the other cereals at all meals. All this is immaterial, so long as the amount of flour purchased directly and indirectly is held to the denominated figure, six pounds.

The practical concern to the housewife lies in the preparation of the different cereals. The use of large amounts of substitution cereals depends upon the conditions in the larder outside of cereals. Anglo-Saxons do not relish the direct consumption of boiled cereals. Rice is in itself quite tasteless and requires the presence of flavouring substances, such as curry, meats or fats; brown rice has a better flavour than polished rice. Oatmeal appeals to few people unless eaten with milk and sugar. The same is to

be said of cornmeal mush, while fried cornmeal and hominy are usually consumed with syrup or with meats. All cereals are relished with fruits. Fortunately for us, we possess the sugar, fruits, meats, fats and dairy products necessary to enable the housewife to prepare rice, cornmeal, hominy, barley, oatmeal and other cereals in an infinite variety of ways. It is precisely in the possession of these foodstuffs, that make the use of substitution cereals easy, that the American housewife occupies the position of advantage over the women of the Allies, who are short of fruits, sugar, dairy products, meats and fats. Success in the use of substitution cereals in this country is merely a question of desire. The common degree of culinary skill and household ingenuity will enable any woman to restrict the consumption of flour in her family to

six pounds per person per month, and to serve substitution cereals in such ways as to evoke the satisfaction both of the adults and children. A bungling housewife is a pro-German influence, in fact if not in intention.

The direct use of substitution cereals is most easy to people of means and to those living in the country and in towns and small cities, since they have access to the adjuncts that make these cereals acceptable. The people living in the congested sections of large cities would find such a mode of subsistence onerous and expensive, and since they cannot be asked to carry out the full program, the more strict observance is imposed upon the rest of us, in whose power it lies to live on the least wheat, even with no wheat.

For those who live in public eating houses, this method of direct substitution is not so feasible. Oatmeal,

cornmeal, hominy and rice are often badly prepared and unattractively served in public houses. These cereals require thorough cooking and are best prepared in small amounts. The easy thing for public eating places is to serve bread with meats and vegetables. Anyone who attempts to maintain a vegetarian or cereal diet in a public eating place will find the practice difficult. Thus the world over the saving of wheat is hardest in public eating places. The most effective method is to prohibit the serving of crackers and the like and limit the permissible portion of bread to two ounces.

The second method is the use of *mixed flours*, the dilution of wheat flour with other cereals. European nations have now accumulated experiences in the admixing of flours upon such a large scale that we may accept

their findings as conclusive. Standard bread of normal characteristics cannot be prepared commercially with less than 70 parts of wheat flour, except in the case of rye, where a good half-and-half bread can be prepared. With barley, oatmeal, cornmeal, rice, potato and other diluting flours, 70 parts of wheat flour are required to 30 parts of substitution flour for the simple reason that this is the minimum amount of wheat furnishing the gluten necessary to produce a bread of standard characteristics.

The best mixed-flour bread is prepared from flour of standard extraction. For practical purposes it does not make much difference what the diluting flour is. If the substitution flours do not cook as rapidly as wheat flour, which is true of cornmeal and oatmeal, it is advantageous to have them pre-cooked. Thus, in the house-

hold, the best method of making mixed-flour bread of oatmeal, rice or corn-meal is to cook these cereals, mash them thoroughly and work them into the dough. In the case of potatoes, cooking is always advantagous. Commercial bakers, of course, cannot proceed thus. They must adapt the processes of baking to the characteristics of the particular mixture, and they have learned in Europe to produce fair breads upon a commercial scale. Thirty per cent. of cornmeal is too high; twenty should not be exceeded. Fifty per cent. of rye, thirty per cent. of barley, twenty-five of rice and oatmeal and twenty per cent. of corn represent proportions that can be employed by commercial bakers or in the household with perfect satisfaction. Expert housewives can use larger admixtures with small batches.

Success is modified by the extrac-

tion of the diluting flours. Barley should be milled to 60 per cent., rye to 70 per cent.; degerminated cornmeal makes the best-looking loaf, but whole corn meal is satisfactory.

These breads are usually not as light and fine in texture as straight wheat breads. They do not remain moist quite as long; they do not toast as perfectly, and they may present a slight taste of the diluting grain. If barley flour is extracted to 70 per cent., it lends a taste to the bread containing it; if extracted to 60 per cent., this is not the case. Rice tends to give a pastry-like texture if used in large amounts. Cornmeal tends to give a granular quality to the bread containing it. Potato bread, when made under careful supervision, is a very good article; but applied to commercial baking the bread is difficult of control. The writer has eaten much potato

bread in Germany, containing all the way from 10 to 30 per cent. of potato, prepared both with wheat and rye flour, and has seen few good breads turned out upon a commercial scale. Ten to fifteen per cent. of potato can be added to bread in household baking without the slightest sign in the finished product.

Of course, the technique of baking must be modified, both in the bakery and in the household, in accordance with the particular ingredients involved. When one uses wheat flour to 70 per cent. of the mass, one must reduce the period of fermentation. It may be found that a slightly higher or lower temperature during the period of fermentation is advantageous. The baker and the housewife will find a higher or lower temperature in baking advantageous to produce breads best adapted to the taste of the family

and the trade. Here again success depends upon desire. The baker who wants to turn out a mixed bread containing eighty or even seventy parts of wheat flour, such as the present standard flour of this country, and twenty or thirty parts of diluting flours can produce bread of normal appearances and standard qualities.

Mixed-flour bread represents the best method of stretching wheat in the subsistence of the inhabitants of the congested area of our large cities, indeed for the very poor it may be the only practicable method.

Recent additions to the list of wheat-flour substitutes are flours of peanut, banana, sweet potato, sorghum grains and others. These are good products, but they find their best use not in yeast-risen breads but rather in quick breads, cakes and similar preparations.

The third method is *higher extraction of flour*. By extraction, expressed in percentage, we mean weight of flour obtained from the unit weight of cleaned grains. The pre-war extraction in this country was 70 to 72 per cent.; that is, one hundred weight of cleaned wheat produced seventy or seventy-two pounds of flour in total. This flour was contained in several trade grades. The finest patent flour represented about 56 per cent. extraction. Then there were bakers' patents and straight flours. The sum of these equaled 70–72 per cent. We have abolished these gradings of flour and our mills now produce a standard flour of uniform extraction, practically 75 per cent. upon the American scale. In order to understand the advantages and disadvantages of higher milling, it is necessary to enter a little into the

structure of wheat and the processes of milling.

Wheat is composed of three parts; the endosperm, which is the main body of the berry; the germ; the hull or coating. Our standard wheat flour contains only the endosperm and represents practically a 75 per cent. extraction. The remaining 25 per cent. is known in the trade as grain offal or mill-feed, and is used largely as a concentrated food for live stock, being prized in the feeding of dairy cattle. This fraction of grain offal contains a number of over-lapping sub-fractions, which are known in the trade as red-dog, shorts, middlings, and bran. A portion of the red-dog is contained in the lowest grade of straight flour. It is possible to separate roughly the grain offal into two parts; one containing the germ and the finer offal, and

the other containing the coarser offals, largely bran. In comparing American and European extractions, the water content of flours must be kept in mind. Here the flour contains about 13 per cent. of water, in Europe higher water content is permitted, 17 per cent. being common. In other words, our 75 per cent. extraction corresponds to a 78 per cent. extraction in Europe.

Standard wheat can be extracted to about 78 per cent. without inclusion of the germ, but with inclusion of some of the red-dog. The germ fraction will be found in the next 10 per cent., the material between the 78 per cent. and 88 per cent. The germ itself is probably not over 2 per cent. of the weight of the grain, but in the practice of milling it is found in the upper fraction of red-dog, shorts, and in the finer grain offal. This middle

fraction, (which we may term the germ fraction, denominating the coarser grain offal as the bran fraction), is as rich in carbohydrate as straight flour and is appreciably richer in protein. From the standpoint of nutritive units, either expressed in analysis or in physiological tests, there is gain when wheat is milled to 88 per cent. as compared to 78 per cent., this gain being especially in the direction of protein.

The nutritive content of the bran fraction, that is above 88 per cent., is low. It is largely cellulose and mineral matter. The germ contains both ferments and bacteria, and is, therefore, prone to decomposition. The ferments split the fats, making them rancid. They act upon the protein also. Aided by bacteria, they produce the musty decomposition that is liable to occur in coarse flours, and

does not occur in standard flours under the same circumstances. Flours extracted to 88 per cent., that is, containing the endosperm and the germ fraction, do not keep in the same way that the standard flours keep. They possess a distinctly different taste, and breads made from them carry this taste,—a taste that is not unpleasant. Flours extracted to 85–88 per cent. have, for practical purposes, come into common use only during this war. Before the war in Europe and in this country, we had patent, bakers patent, straight flour and so-called graham and whole wheat flours. Graham flour is supposed to contain the entire wheat berry. Whole wheat flour is supposed to be produced after decortication of the berry. In actual practice, there is very little of such flours produced in the United States. What is sold for graham and whole wheat

flour is standard flour into which the bran fraction has been sifted back; it does not contain the germ fraction, i.e., it is degerminated. In other words, it does not possess the nutrients of the germ fraction, but is merely standard flour to which the roughage of the bran fraction has been added. Graham flour prepared by sifting bran back into standard flour keeps fairly well. The true graham flour keeps badly on account of the tendency of the germ to decompose. It is possible on a small scale to sterilize whole wheat flour, but this has never been attempted upon a large commercial basis.

Now it is clear that the nutrients could be increased, that is, wheat flour stretched, by raising the extraction from our present figure of 75 per cent. to 88 per cent. Whether it would be wise to do this depends upon the an-

swers to three questions. Will the flour keep under the conditions in which flour is used in the United States? Are the breads prepared from higher extraction flours satisfactory? Do these breads agree with the digestion of the consumer?

As regards the first question, it would certainly lead to losses if all the wheat in America were milled either to European standard of 85 per cent. or 88 per cent., or prepared as whole wheat flour and distributed through the American market as at present controlled. It is possible in Europe to mill wheat in their way because the flour is consumed within a few weeks after it is produced. In Europe there is practically no such thing as household baking, and flour is consumed promptly after leaving the mills. Here sixty per cent. of the people bake their own bread, half of our flour en-

ters the household larder, different classes buy flour in large amounts, it must keep for months under difficult conditions of temperature and moisture. The common experience with whole wheat flour is that it spoils rapidly, even in the hands of the trade; and this is one reason why whole wheat flours are expensive. Unless some control could be devised whereby the consumption of flour would occur within a few weeks of production, we may be sure that to include the germ fraction in the flour would lead to heavy losses. These losses would cause grave dissatisfaction, and would probably more than balance the increase in the amount of flour gained through higher extraction. To prepare all of our flour in the state of our present graham flour, merely sift back the bran into standard flour, would for practical purposes only add

roughage and would not contribute to nutritive value. The additional nutrient lies in the finer offal, where, unfortunately, also resides the tendency to decomposition.

The writer has tested several whole wheat flours made by small mills that employ cutting or crushing rather than rolling. These flours yield very good breads, better than any made from ordinary whole wheat flours. In a certain sense, these whole wheat flours bear the same relation to the common whole wheat flours that water-ground cornmeal bears to the common meal. Like water-ground cornmeal, unfortunately, these special whole wheat flours cannot be produced upon a large scale.

Breads made from flours containing the endosperm and the germ fraction are not usually good breads. The writer has eaten breads baked from

flours of 81, 85, 88, 93 and 97 per cent. extraction in Germany, England and France. European bakers have worked for over two years to produce good breads from these flours. It has not been routinely accomplished in any country. The methods of bread baking are very different in France, Italy, Germany and England. The standards of what constitutes good bread and the tastes of the public are different. In not one of these countries have the bakers been able to meet the tastes of the consuming classes with breads made from flours containing the endosperm and the germ fraction. The loaf is smaller, the moisture content higher, often tending to sogginess, does not crust well, does not toast well, and remains, when all is said and done, an unsatisfactory bread. The revulsion against this bread has been audible in every country, the people

have repeatedly petitioned that they be given less bread and better bread. France once reduced her extraction five per cent. in order to meet the wishes of the people. In every country they furnish to soldiers bread made of lower extraction flour than the standard issued for the civilian classes. The graham bread made in this country from flour produced by sifting bran back into standard flour is much better than the average war-bread of Europe, produced from an 85 per cent. extraction that contains the germ but does not contain the bran. The presence of bran seems to aid in holding up the texture of the bread and making it lighter. True whole-wheat bread is lighter and better than the war-bread of Europe made from 81–88 per cent. extraction.

It has been the experience in the European countries that breads pre-

pared from higher extraction flours do not agree with many individuals. This holds as true of breads made from the 85 per cent. extraction as from the 93 per cent. extraction. Many children and adults fail to digest these breads. The result is discomfort and often colic, gaseous fermentation, and resultant disturbances of intestinal functions. It is not merely the result of increased roughage in the diet. Graham breads made of flour produced by adding bran to standard flour do not disagree with people in this country in the way that the 85 per cent. extraction breads of Europe disagree with people there. The disagreement lies apparently less in the bran fraction than in the germ fraction, or in the resultant changes in the bread that the germ fraction introduces. The disturbances are usually not serious, except in children,

but they accentuate the dissatisfaction with the breads. If a bread does not look like good bread, keep like good bread or taste like good bread, and in addition does not agree as does good bread, the sentiment of the people turns against it, and higher extraction can be justifiable only on the ground of dire necessity. It is the experience of the nations at war in Europe that they would abandon higher extraction and return to mixed flours prepared from standard flour, provided this were possible. Breads made in England of standard American flour diluted with an admixing flour are much better than straight breads of 85 per cent. extraction flour. The Victory Bread of the United States is so superior to the war-bread of the Allies and of the enemies as to be past comparison. Not only is the quality of Victory Bread ex-

cellent, but it contains more calories to the pound than straight wheat bread.

One plea in favour of whole wheat flour frequently advanced is that it contains vitamines and mineral matters that are not contained in standard flour. This is true. There are no studies to indicate the richness of the middle or germ fraction in vitamine and mineral matters. One might infer that the vitamine is contained in the germ fraction and that the mineral matters are contained largely in the bran fraction, but this is an inference and not a statement of analysis or experiment. When the diet lacks minerals, roughage and vitamines, then the use of whole grains is necessary. But, it is precisely in war-time that this is not likely to occur. In the diet of the nations at war there is a profusion of vegetables, more than in peace-time, that contain minerals,

roughage and vitamines freely. Go where one will, in the United Kingdom, France, Germany, Switzerland or Holland, one finds the diet of the people today rougher, coarser, and containing more vegetables and less concentrated foodstuffs than in peace-time. As a people adapt themselves more and more to the exigencies of war-time stress, they turn to coarser plants, the diet becomes more vegetarian. With our war gardens of last year our people consumed vegetables in excess of previous custom and that will be the case again this year. Vitamines and mineral matters are not contained in the covering of the grains in a particular or exclusive manner. All fruits and vegetables contain water-soluble vitamines. Milk and beef and leaf vegetables are rich in fat-soluble vitamines, in which the grains are poor. We must develop

the use of dairy products in order to conserve the invaluable fat-soluble vitamines which the grains cannot give us. Under these circumstances, the plea for whole-wheat flour in the American diet today fails of justification from this point of view. People should be allowed to select their roughage, whether in the form of fruits or vegetables or in the form of whole grains. They should be allowed to select their mineral salts and vitamines in the same manner, and both are freely available. The legal distinction between food conservation and health propaganda must be kept in mind. It is argued in favour of whole wheat flour that its use might relieve or prevent constipation, rickets, scurvy, anæmia, and pellagra. But the function of a food administration is to secure and conserve food, not treat pre-existing diseases in a

compulsory manner, applied to the majority who are not afflicted as well as to the minority who may be diseased but still possess the right to select their treatment. In each country at war diet fads are being pushed at the food administrations, who must confine themselves to the specific functions defined by legislative authorization.

Nutrient units are to be gained, as a war-time proposition in Europe, in flours of whole wheat. It is possible that we could extract our grain somewhat higher, 78–80 per cent., without loss of flour through decomposition. But the idea of milling all our wheat as whole-wheat flour cannot be commended from any point of view, as a war-time proposition applied to the American people. There is an abundant production of whole wheat flour for those who desire it. Mixed-flour

breads and the use of supplementary cereals in substitution of bread represent for the average American the best solution of the problem of stretching our scanty supplies of wheat.

When a people possesses very limited supplies of bread grains, it may find itself driven to stretchings that are largely or wholely dimensional and not nutritive. That has been the situation of the German people several times during the past two years. Very short of wheat, rye and barley, and having no oats, corn, rice or other cereals that could be substituted, certain classes in Germany have fallen back upon such diluents as birch buds, straw, clover hay and wood pulp. The birch buds and clover hay offer a limited amount of nutrients to the human digestion, the straw and wood offers none, as careful tests in Germany have demon-

strated. Nevertheless cellulose bread, as it has been termed, is still recommended, since it enlarges the size of the loaf and acts as filling for the digestive tract. Alfalfa flour mixed with wheat flour makes a good bread; it is indeed an open question whether, from the standpoint of constituents, flour of ordinary flour plus alfalfa would not be esteemed superior to whole wheat flour. Feeds can of course be used as foods; but with our supplies of oats, barley, rice and corn, to say nothing of white and sweet potato and peanut, we are driven to no such alternative, even should our supplies of wheat and rye unhappily continue low through another year.

Whatever the state of our stocks of wheat, our stock of courage must remain high.

WASTE IN WHEAT

THERE is a considerable waste in bread-grains, although it is not capable of accurate measurement, both in the industrial use of flour and in subsistence. There is a considerable feeding of wheat to poultry and other domesticated animals, and it is not all screenings by any manner of means. Wheat flour is used in certain textile processes, in pastes, in foundries and in a variety of minor industrial operations. The wheat flour thus used is supposed to be made of wheat of low grade, or flour condemned for purposes of human food. As a matter of fact, a considerable amount of straight flour has been devoted to these ends.

There is, apparently, little waste of flour in the commercial baking of bread, but there is a considerable waste in connection with marketing. It has been the custom of bakers to supply retailers with amounts of bread in excess of their usual trade in order that they should never run short, just as in the case of newspapers. The unsold bread the retailer was permitted to return. The old bread was thereupon sold by the baker at lower prices to the poor in cities, or was sold for animal consumption. This waste, which was not inconsiderable, represented merely an economic convenience, and under the present regulations of the Food Administration bakers accept no bread returns. Anything that makes the baker judge his trade more accurately tends to reduce the consumption of bread but it tends

also to increase slightly the cost to the baker.

In the actual baking operations, there is very little waste in commercial bakeries. Their formulas are well worked out, the amounts of ingredients accurately standardized, the temperature is regulated, the period of fermentation under control, the heat of the ovens is properly maintained and very few batches go wrong. In an attempt to produce new breads, such as Victory Bread, bakers may encounter losses for a few days; but with the use of standard flour 75 parts and substitution 25 parts, or even with a combination of seventy and thirty, bakers should produce bread of good quality without loss.

There is some waste in the use of flour in baking in the home. If the family does not contain many hard

workers, the tendency is to prepare a larger batch of bread than can be consumed in the time that bread will remain fresh, and unless ingenuity on the part of the housewife in the utilization of stale bread is highly developed, a great deal of stale bread goes to dogs, cats and poultry, and into the garbage pail. All investigations of garbage in cities indicates that there has been a considerable waste in stale bread. This was also true in the cantonments in the early months of the war, and represents a type of waste to which we as a people had become accustomed. By a check-up in waste bread, and by the issue of flour only as it is needed, the flour consumption of the cantonments during the past three months has been reduced over one-half from the figure of issue to the regular Army for 1913. This illustrates how much can be accom-

plished through far-sighted conservation. Where flour is used for quick breads, as in the preparation of baking powder biscuits, hot cakes, etc., if these are not consumed at the time of baking, they are often not eaten at all; and unless baking of these articles is restricted to the actual amount needed, there is waste of flour.

Household waste of flour is a matter that is directly and solely up to the housewife. If she will control her purchases of flour, carefully gauge all preparation in proportion to the number in the family and the work they are doing, and make it a rule that any product of flour is not to be thrown away or fed to animals under any circumstances, the waste of flour in the household will be practically eliminated. The crucial feature of control lies in limitation of purchase. If the housewife buys not more than

six pounds of flour per person per month, directly and indirectly, she forces herself to face the alternative of *waste* or *use* up to this figure; then it will be found that waste will be eliminated and the flour will be consumed.

. . . . .

Every American has been asked to buy a war bond. Every American is now asked to save wheat. To buy a bond is an investment, to save wheat is a duty as well as a task, our first war burden. Our people must solve this problem. We must solve it, because the subsistence of our Allies depends upon the solution. We must solve it because our own subsistence would be jeopardized by failure. But even wider considerations make success of crucial importance. Morale is involved. The morale of our Allies will be raised by our success or low-

ered by our failure, they will interpret our war spirit in the light of our reaction to this problem. Our morale will be raised by success in this undertaking or lowered by failure, because we will judge ourselves by the outcome. With sound native spirit, conscious of the justness of our cause, in the impelling ardour of youth but without definition by the individual of the things that make for warfare, we are driving forward. Success in the first steps means much, like a good start in a race. We must save in many things in this war, let us get into the saving stride now. In facing the first definite act of reconstruction of our lives as a step in warfare, each stands before the bar of individual conscience.

By their bread shall ye know them!

PRINTED IN THE UNITED STATES OF AMERICA

THE following pages contain advertisements of books by the same author or on kindred subjects.

The Food Problem

By VERNON KELLOGG AND ALONZO E. TAYLOR *$1.25*

"Food is always more or less of a problem in every phase of its production, handling and consumption. It is a problem with every farmer, every transporter and seller, every householder. It is a problem with every town, state and nation. And now very conspicuously, it is a problem with three great groups, namely the Allies, The Central Empires and The Neutrals; in a word it is a great international problem."

These sentences from the introduction indicate the scope of *The Food Problem* by Vernon Kellogg and Alonzo E. Taylor.

Both authors are members of the United States Food Administration. Dr. Kellogg is also connected with the Commission for relief in Belgium and professor in Stanford University. Mr. Taylor is a member of the Exports Administrative Board and professor in the University of Pennsylvania. The preface is by Herbert Hoover, United States Food Administrator and Chairman for the Commission of Relief in Belgium.

The food problem of today, of our nation, therefore, has as its most conspicuous phase an international character. Some of the questions which the book considers are:

What is the Problem in detail?

What are the general conditions of its solution?

What are the immediate and particulars which concern us, and are within our power to affect?

And finally, what are we actually doing to meet our problem?

TABLE OF CONTENTS

Introduction: The International Problem.

Part I. The Problem and the Solution.

Chapter I. The Food Situation of the Western Allies and the United States.

II. Food Administration.

III. How England, France and Italy are Controlling and Saving Food.

IV. Food Control in Germany and Its Lessons.

Part II. The Technology of Food Use.

Chapter V. The Physiology of Nutrition.

VI. The Sociology of Nutrition.

VII. The Sociology of Nutrition (Continued).

VIII. Grain and Alcohol.

Conclusion: Patriotism and Food.

THE MACMILLAN COMPANY

Publishers 64–66 Fifth Avenue New York

SOME ASPECTS OF FOOD ECONOMY

By MARY S. ROSE

Everyday Foods in War Time

$.80

This little book was written in response to a request for a "war message about food." It gives a simple explanation of the part which some of our common foods play in our diet, and points out how the necessary saving of fat, fuel, sugar, and meat can be made without a loss of health or strength.

There are chapters on the Milk Pitcher in the Home; Cereals We Ought to Eat; Meats We Ought to Save; The Potato and Its Substitutes; Are Fruits and Vegetables Luxuries? Sugar and Spice and Everything Nice; On Being Economical and Patriotic at the Same Time.

Feeding the Family

$2.10

This is a clear concise account in simple everyday terms of the ways in which modern knowledge of the science of nutrition may be applied in ordinary life. The food needs of the members of the typical family group — men, women, infants, children of various ages — are discussed in separate chapters, and many illustrations in the form of food plans and dietaries are included. The problems of the housewife in trying to reconcile the needs of different ages and tastes at the same table are also taken up, as are the cost of food and the construction of menus. A final chapter deals with feeding the sick.

THE MACMILLAN COMPANY
Publishers 64–66 Fifth Avenue New York

The Book of Cheese

By CHARLES THOM

Mycologist in charge of Microbiological Laboratory, Bureau of Chemistry, United States Department of Agriculture; formerly Investigator in Cheese at Connecticut Agricultural College

AND

WALTER W. FISK

Assistant Professor of Dairy Industry, New York State College of Agriculture at Cornell University

An exposition of the processes of making and handling a series of important varieties of cheese. The kinds considered are those made commercially in America or widely met in the trade here. The relation of cheese to milk and to its production and composition has been presented in so far as required for this purpose.

After a general statement on cheese, the authors consider the following subjects: The milk in its relation to cheese; Coagulating materials; Lactic starters; Curd making; Classification of cheese; Cheese with sour milk flavor; Soft cheeses ripened by mold; Soft cheeses ripened by bacteria; Semi-hard cheeses; The hard cheeses; Cheddar cheese making; Composition and yield of Cheddar cheese; Cheddar cheese ripening; The Swiss and Italian groups; Miscellaneous varieties and by-products; Cheese factory construction, equipment, organization; History and development of the cheese industry in America; Testing; Marketing; Cheese in the household.

THE MACMILLAN COMPANY
Publishers 64–66 Fifth Avenue New York

THE RURAL TEXT-BOOK SERIES

EDITED BY L. H. BAILEY

Butter

BY E. S. GUTHRIE

Professor in the Dairy Department, New York State College of Agriculture, Cornell University

A practical discussion of the general characteristics of butter, and of all of the problems connected with its manufacture and marketing, together with a brief history of the product. Among the topics considered are the history of butter; composition and food value of butter; cleansing and care of dairy utensils; care of milk and cream; cream separation; grading milk and cream and neutralizing acidity; pasteurization; cream ripening; churning, washing, salting and packing butter; flavors of butter; storage of butter; marketing; whey butter, renovated and ladled butter; margarine, and testing.

THE MACMILLAN COMPANY

Publishers 64–66 Fifth Avenue New York

3 1197 00448 6020